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## CRITICISMS AND DISCUSSIONS.

### PHYSICS AND METAPHYSICS.

Sir Oliver Joseph Lodge (knighted for proficiency in physics) asserts that "life can generate no trace of energy, it can only guide it"; from which he infers that life is immaterial or hyperphysical. The answer to his assertion, I should say, is what the lawyers call a demurrer. The assertion is true; but the inference which he draws from it does not follow. Life cannot generate energy, to be sure. Nor can energy itself. Nor can anything else. The total energy of the universe is constant, admitting of neither generation nor destruction, as fixed by the law of the conservation of energy; a law, by the way, not generalised from experience, but a necessity of thought, to which all experience is subject, and which consequently is as little liable in the future to have a "question mark" placed against it by competent thinkers as the law of identity or the law of contradiction or any other part of the organic law of mind. In general, it may be said, the uniformities of mind, not excepting the absolute uniformities, answer to uniformities of matter, a subjective necessity being the obverse of an objective impossibility. The inner is the outer, transformed, not transnated. Resuming, the point to be proved in this discussion is not that life cannot generate energy, but that life cannot transform energy—is not a link in the endless chain of physical transformations. Professor Lodge is guilty of what the logicians know as *ignoratio elenchi*. He has mistaken the question in dispute. Energy is not generated, but is transformed, and life indisputably transforms energy—generates not energy but forms of energy. Life does nothing more or less than generate forms of energy. It consists in generating them—subsists by generating them. The distinction between energy and forms of energy, constituting the basis of physics, the distinguished physicist would seem to have overlooked, probably because the content obscured it. When Yankee Doodle came to town he could not see it for the houses.

How can life guide energy without itself having energy, one may ask in all seriousness? The deserved prominence of Sir Oliver Lodge among scientific people will excuse an examination of the mode in which he works out his fallacy. Guiding implies changing the direction of motion, which, if we may accept the law of motion accepted by physicists from Newton to Lodge or next to Lodge, can be done

only by force in the sense of something active. "Guidance," he nevertheless insists, "is a passive exertion of force without doing work; as a quiescent rail may guide a train to its destination, provided an active engine propels it"—a non-descript force, which he may be pardoned for not describing intelligibly—a sort of *tertium quid*, we may suppose, like St. Augustine's "light and air," part physical, part hyperphysical.

What is work, in the scientific conception of it? Moving through space against resistance, the scientists say; and the definition holds intrinsically no matter how small the space or how slight the resistance, applying in principle (nothing but principle concerns us here) equally to molecules and to the bodies which they compose. The work done in moving a train to its destination is, first, making the train move through space, and, secondly, making it move in the direction of its destination; of which factors the "active engine" supplies the one, the "quiescent rail" the other. Both are necessary. In the absence of either the train could not reach its destination—the work could not be done. Not the "red devils" of Paris or Narragansett Pier could reach their destination (were it anything but smash), unless directed by force homogeneous with the force that propels them.

As for the passivity of the guiding force, since the reaction of the rail on the engine equals the action of the engine on the rail, the two forces are equally passive, equally active. A force in equilibrium is not a passive force, but a force whose activity is balanced by that of a counter force. The resultant of forces in equilibrium is zero, but their activity is quantitative, and may be the maximum of one or both. The conception itself of equilibrium presupposes forces acting against one another. A body even in sensible motion, if the motion be uniform, is in equilibrium. Indeed, the forces acting upon a moving body at any instant, as the principle of d'Alembert affirms, may be resolved into a state of equilibrium. Equilibrium is thus kinetic as well as statical. "Statics," as a physicist of note remarks, "is but a special case of kinetics."

It is a static or equilibrated force which Sir Oliver Lodge pronounces "purely passive"—not "anything active"; and, as he uses these expressions in a philosophical inquiry, and rests his conclusion upon them, he may be held to use them in their absolute sense. In any other sense, for that matter, they are self-evidently of no use in his argument, which is employed to support the assumption that "life" and "energy" differ so radically as not to be interconvertible—as to have no common ground. A relative instance cannot illustrate, much less prove, an absolute distinction. Force at bottom is matter in motion; whether the motion is molar or molecular, sensible or insensible, is fundamentally indifferent. A force not "anything active" is a contradiction in terms. A "passive exertion of force" is a topping contradiction—Pelion upon Ossa piled.

Molecular activity may seem compatible with molar passivity, but molar passivity is seeming only, for, moved by gravitation, masses individually as well as particles act unceasingly, the tendency to act, comprehended in the law of gravi-

tation, being a stage or phase of action. Activity belongs to matter in all its forms, respectively—to each combination as a whole no less than to its simplest constituent. When a stone falls to the earth, the earth, taking into account both velocity and mass, does as much falling as the stone, and shares equally in the stress of the resultant equilibrium. No aggregate, as no aggregant, is "purely passive." On the ground floor of physics there is no room for the word "passive." The universe is of activity "all compact." This is commonplace to Professor Lodge, yet in the paper in hand he reasons as if he rejected it or had never heard of it.

A particle of the rail, to recur to his illustrative case (if I may dwell a moment longer on the point), which changes its position with reference to another particle without changing its distance, exerts essentially the same kind of force as the rail or as the engine that wheels upon the rail—a force not only active, but entirely physical, and, moreover, consisting exclusively in the change in the direction of the particle. This is the force to which, in a discussion of ultimate principles, life is gravely compared by a scientist of the first distinction, for the purpose of showing that life is hyperphysical—void of physical energy, and incapable of giving rise to any form of it.

The maze of technicalities in which mathematical physicists have enveloped physics, either for their own convenience or to render their science "caviare to the general," has no place in discussions so fundamental as the one under notice. He who should seek to escape from the pressure of unsophisticated reason, by taking refuge in the windings of this labyrinth, would add nothing to the sum of human knowledge, and might subtract something from whatever just fame he had achieved. What the world asks from science is not superstition or prejudice adorned with refinements; but truth unadorned. If the gem is not given, the setting may be spared.

To speak literally, does Professor Lodge, trained and accomplished physicist as he is, really mean that the direction of a body moving against resistance can be changed not simply without doing work, but without activity at all? If he does, what, in his opinion, has become of the law of motion formulated in its threefold aspect by Newton? If he does not, what becomes of his contention?

Continuing, our physicist or metaphysicist illustrates his position as follows:

"Scribbling on a piece of paper results in a certain distribution of fluid and production of a modicum of heat; so far as energy is concerned, it is the same whether we sign Andrew Carnegie or Alexander Coppersmith, yet the one effort may land us in twelve month's imprisonment or may build a library, according to circumstances, while the other achieves no result at all. John Stuart Mill used to say that our sole power over nature was to *move* things; but strictly speaking we cannot do even that; we can only arrange that things shall move each other, and can determine by suitably preconceived plans the kind and direction of the motion that shall ensue at a given time and place. Provided always that we include in this category of 'things' our undoubtedly material bodies, muscles and nerves."

In arranging that things shall move each other, do we not move "our undoubtedly material bodies, muscles and nerves," without moving which, indeed we cannot so much as plan or even think, be the movement duplicated hyperphysically or not? That one cannot exert his mind, without moving his body as the organ of his mind, if nothing more, is incontestable. But if we move our bodies we move the things which our bodies move. *Facit per alium facit per se* is a maxim as sound in philosophy as in law. Arranging for whatever purpose, therefore, whether to explode a mine, forge a name, operate a railroad, or take advantage of the forces of nature in any other way, involves not only moving the things arranged or pertaining to the arrangement, and moving them against resistance, but moving, first of all, the things that we call "our bodies, muscles and nerves." If we can move these "undoubtedly material" things, which stand at the head of the "category," why not the whole "category"? Is this eminent physicist one of the "blind guides which strain out the gnat and swallow the camel?" He says that, "so far as energy is concerned, it is the same whether we sign Andrew Carnegie or Alexander Coppersmith," which latter name has five letters more than the former. Whence comes the energy to scribble these letters, expressing the difference between the two signatures? If energy takes no account of this difference, something else must produce the letters that make it—life, perhaps, or some other force of the metaphysical or preternatural kind to which he refers that of life; but, if life can supply the energy to scribble the difference, why not the energy to scribble the sum? Besides, hyperphysical guidance is as indispensable in forming the several letters of these names, and arranging the letters into the names, relatively unimportant though the task may be, as in planning a forgery, donating a library, or arranging an explosion—directed activities all. If energy may dispense with immaterial guidance in the former operations, which he treats as material purely, why not also in the latter, which he considers a mixture of the material and the immaterial? Why this mixture? Supposing the immaterial to be anything more than the negation of the material, what is it? How can we represent it in thought? How can it express itself or get itself expressed in action? What is the use of it? Can that explain anything else which is inexplicable itself, and inconceivable, to boot? Is not the immaterial, so far at any rate as concerns life and mind, a fifth wheel, to say the least? What is mind, one may reverently ask, but matter not understood—matter of which radium is a clod?

When the author of the hypothesis in question wrote the article which sets it forth, where did the energy given out by his pen come from? Proximately, he will admit, from his muscles, which received it from his nerve-fibres, which in turn received it from his nerve-centers, interacting with each other, and with external things—a form of the physical whose interaction with a physical excitant, be it noted, not only gives rise to forms of energy distinctively physical, but, at the same indivisible instant and inseparably, gives rise to what we name the psychical, which, as conceived from this point of view, is neither of these interacting forms,

singly, nor both together, integrally, but simply and purely their mutual action, with the transformations it sets up in the physical energy stored by such action immemorially in the structure of the more evolved form. The psychical, as thus viewed, is the interplay of the organism and its stimuli, registered organically, retained, and susceptible, under laws solely physical, of reproduction, separation, reconstruction, and, in general, of the processes described collectively as cerebration or mentation, according as they are regarded from the viewpoint of the stimuli or of the organism. But this, as we have seen, is not the author's view. The merely scribal element of the writing he would assign to the physical alone. In his philosophy, it appears, scribing is not directive, and hence is physical; subscribing, on the contrary, is directive and hence hyperphysical. In consideration of the pregnant fact, however, that, while the physical exists independently of the psychical (witness the so-called inorganic world), the psychical confessedly depends on the physical, is conditioned by it, forms the counterpart (the phantom double) of its labyrinthine coursings point for point, what warrant has he, in science or philosophy, for concluding that the thoughts which his written characters were shaped to signify, and which guided his hand in shaping and arranging them, belong not to the physical at all, but to the hyperphysical alone? Where are the facts of experience—where the canons of reason—which I do not say necessitate but which permit this conclusion? I am using the term *psychical*, let me say parenthetically, in its ordinary sense of relating only to the human mind. Will Sir Oliver Lodge pretend that the physical has been proved incompetent to account for the psychical? Will he contend, that, before this has been done, we are warranted in turning down the physical, whose existence is known, but whose potentialities are unknown, and calling up an agency the very existence of which is not merely unknown, but unimaginable? Does he fancy that trampling on the law of parsimony is consistent with legitimate philosophising?

The supposed activity of the hyperphysical, no one denies, is identical in form with the known activity of the physical. What distinctive function, then, can the hyperphysical perform, supposing it to exist? Can the entity derive efficiency from a non-entity, which, if it were anything, would be debarred by hypothesis from interacting with the entity? Does the physical become hyperphysical by evolution, increase of degree culminating in subversion of kind, something developing into nothing? Is a fact difficult of comprehension made easier by an unthinkable explanation? But one need not beat about the bush. When an effect is alleged to arise from two agencies, whereof the one is physical, the other not only hyperphysical, but in the production of the effect admittedly incapable either of acting on the physical or of acting apart from it, what is the unavoidable inference? As the hyperphysical cannot act apart from the physical, it cannot of itself produce the effect or any part of the effect; and, since the hyperphysical can act neither on nor apart from the physical, it cannot co-operate with the physical in producing the effect: so that the hyperphysical, unable itself to produce the effect

or to aid the physical in producing it, can exert in the case no influence, auxiliary or principal, and the physical unaided must produce the effect, as on a lower range of development it produces the cloud, the rain, the rainbow. From this conclusion there seems logically no escape. The doctrine which imports a hyperphysical element into the origination of life and mind is demonstrably a delusion. The hypothesis, if thinkable, would be self-destructive. Unless I mistake, it has fallen in the rear of the procession—is antiquescent, if not antiquated. Soon its surviving friends will be likely to have the melancholy privilege of inscribing on its headstone: "Gone to meet Occasional Causes, and Pre-established Harmony."

Professor Lodge sums up his speculation in these words:

"My contention, then, is that whereas life cannot generate energy, it can exerting guiding force, using the term force in its accurate mechanical sense; not 'power' or anything active, but purely passive, directing—perpendicular to the direction of motion; the same kind of force which can constrain a stone to revolve in a circle instead of in a straight line; a force like that of a groove or slot or channel or 'guide'."

He adds that "life" appears to him "to be something the full significance of which lies in another scheme of things." This undoubtedly is the thought which inspired his "contention," and to which apparently his physics is accommodated. Hence possibly these liberties with the elements of a science in which he is an acknowledged proficient. If so, the less credit to him. A theory may be very well; but, when a theory is used as an altar whereon to sacrifice elementary truths of science, and the sacrifice is performed, the priests of the altar must not complain if profane hands are laid on them.

His recapitulation suggests a word or two. Universally, and philosophically, force is matter in motion (energy); specifically, and scientifically, it is the impulse which changes the velocity or direction (the condition) of matter in motion—a mode of energy. Such as I understand it is "force in its accurate mechanical sense"—the strict acceptance of the term in physics. If life can exert force in this sense, it can "move things" with a vengeance, and is, according to his own showing, everything which he contends that it is not. If life can exert mechanical force in any sense, it is certainly not immaterial, but is as "undoubtedly material" as the body which it animates, and of whose forces it is in fact the moving equilibrium. We have all heard of the bungler who chopped off the tail of his dog just behind the ears. Professor Lodge would appear to have curtailed his argument with much the same maladroitness. He has done for it, anyway. His conclusion and the premises from which he has severed it, may be united "in another scheme of things"—but not in this world.

He exemplifies a guiding force without activity by citing the force which constrains a stone to revolve in a circle. That is to say, he assumes that the force which makes a moving body move in a curved path, continually changing its own direction in the process, is passive, although the circling body reacting against it is

active—that the deflected body exerts activity, the deflecting body none—that though the action and the reaction are equal, the reaction alone is active, the action “purely passive.” An example nobler than a stone, and not less familiar, though even more conspicuously irrelevant, stood at his beck. The sun, above all other things in our region of the universe, exerts a guiding force of the kind cited. In guiding his planetary system, is he “purely passive,” while only the planets which he holds in their orbits are active? Is gravitation active only in the circumference, passive at the center? In a binary star, for further example, which of the members is active, which is passive? Which is the guiding force? Which the guided? Will he kindly draw the line between them, and tell us which is which, and in particular exactly what either is as distinguished inherently from the other?

Attentive readers will probably observe that in this connection our theorist asserts by implication, syntactically speaking, that a stone can be made to “revolve” in “a straight line.” This is a slip of the pen. But judicious readers may think that in point of rationality, not to say conceivability, there is little to choose between this slip, and the movement of his pen in the “groove” which (by “a passive exertion of force”) he took pains to “arrange” for it. They may be emptied at least to pronounce his “contention” bad science and worse philosophy.

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